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Noda

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(54) **TERMINAL FITTING WITH POSTURE CORRECTING EDGE AND INCLINATION RESTRICTING PORTION AND A CONNECTOR PROVIDED THEREWITH**

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H01R 4/72 (2006.01)

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(58) **Field of Classification Search** 439/730, 439/733.1, 722, 852
See application file for complete search history.

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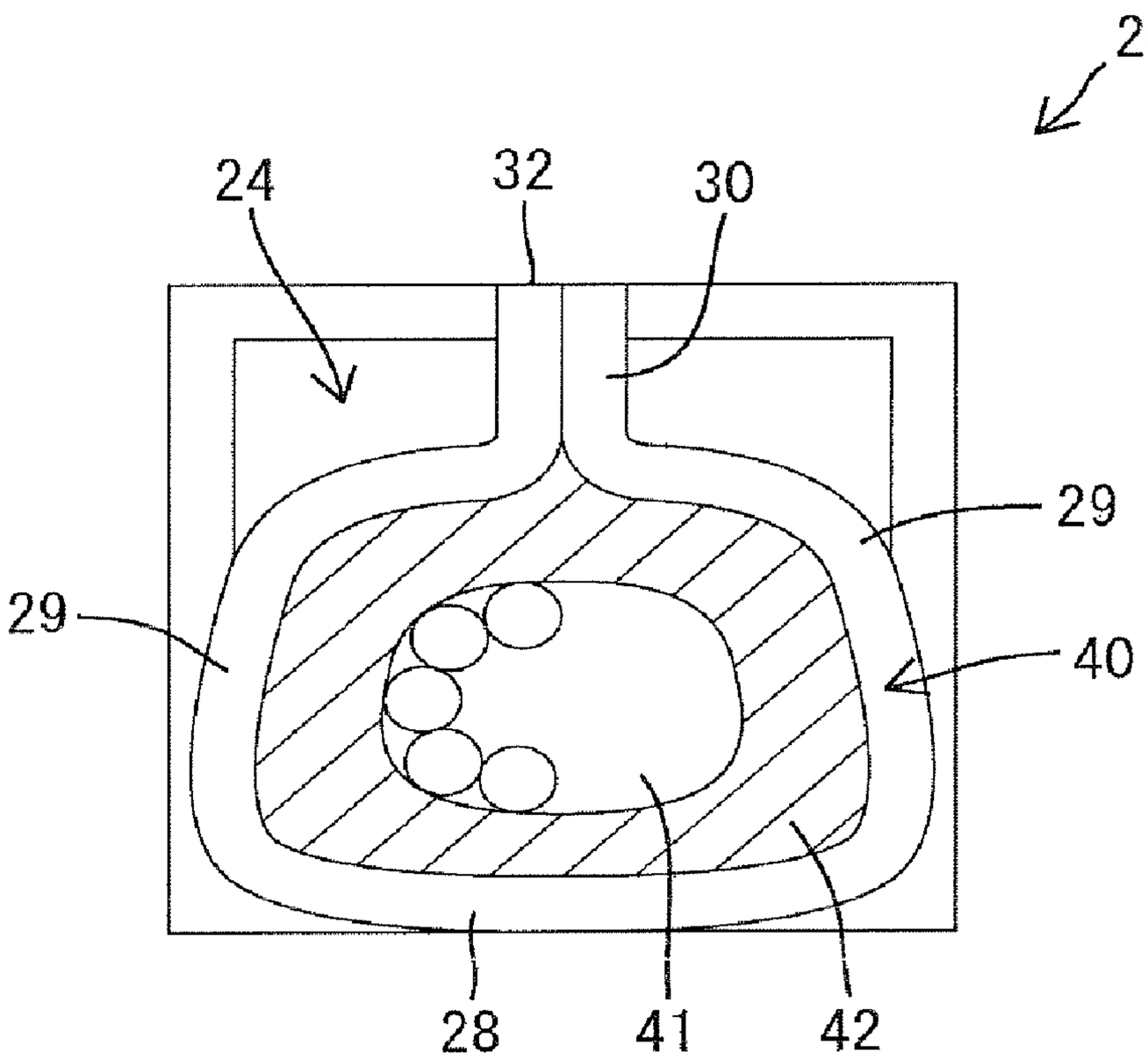
(57) **ABSTRACT**

An insulation barrel (**24**) of a terminal fitting (**20**) is formed with an inclination restricting portion (**32**) capable of restricting an inclination of the terminal fitting (**20**) in a direction intersecting an axial line direction by contacting an inner wall of a cavity (**11**) and a posture correcting portion (**31**) inclined with respect to the axial line direction of the terminal fitting (**20**) and capable of sliding contact with an opening edge at the rear end of the cavity (**11**) in the process of inserting the terminal fitting (**20**) into the cavity (**11**).

11 Claims, 3 Drawing Sheets



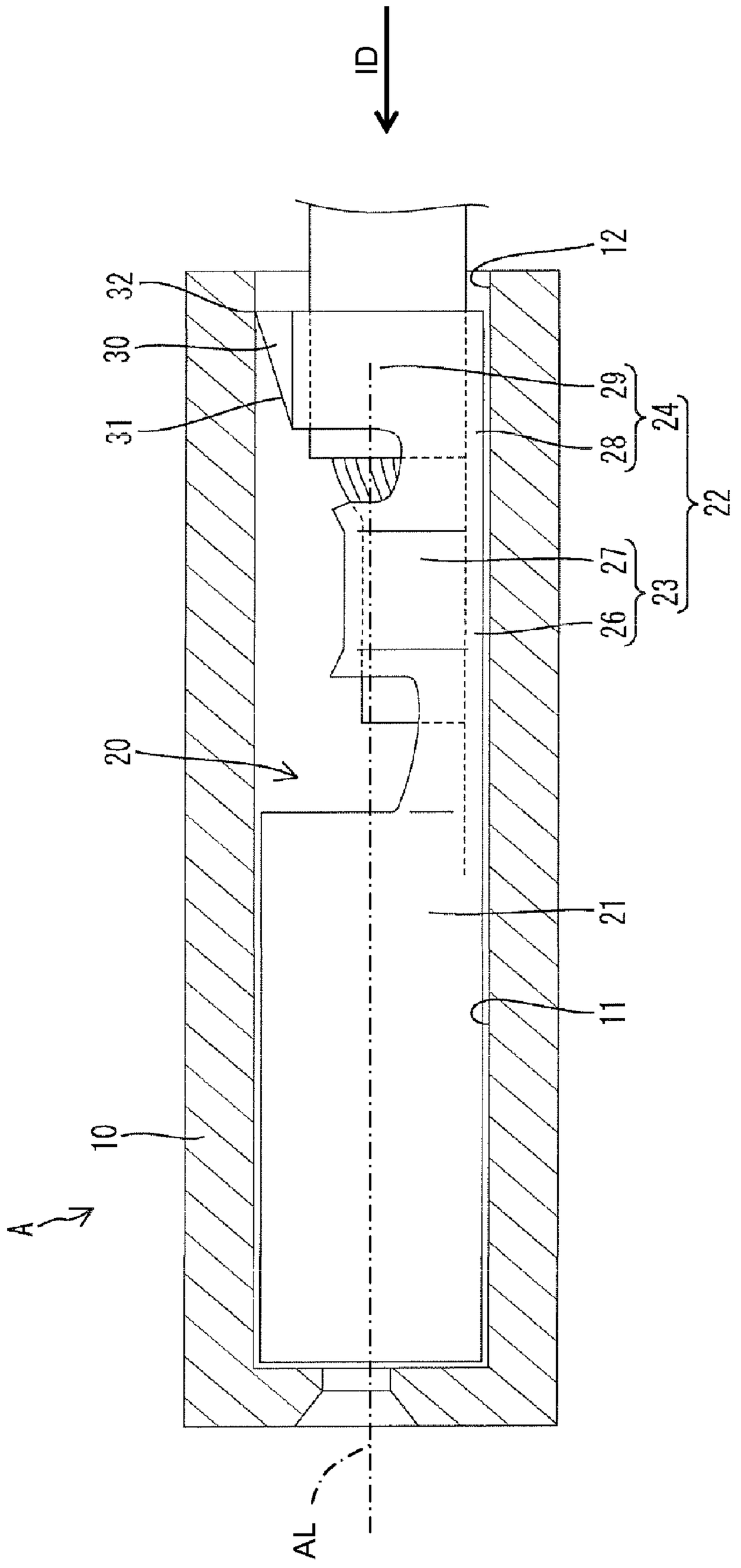
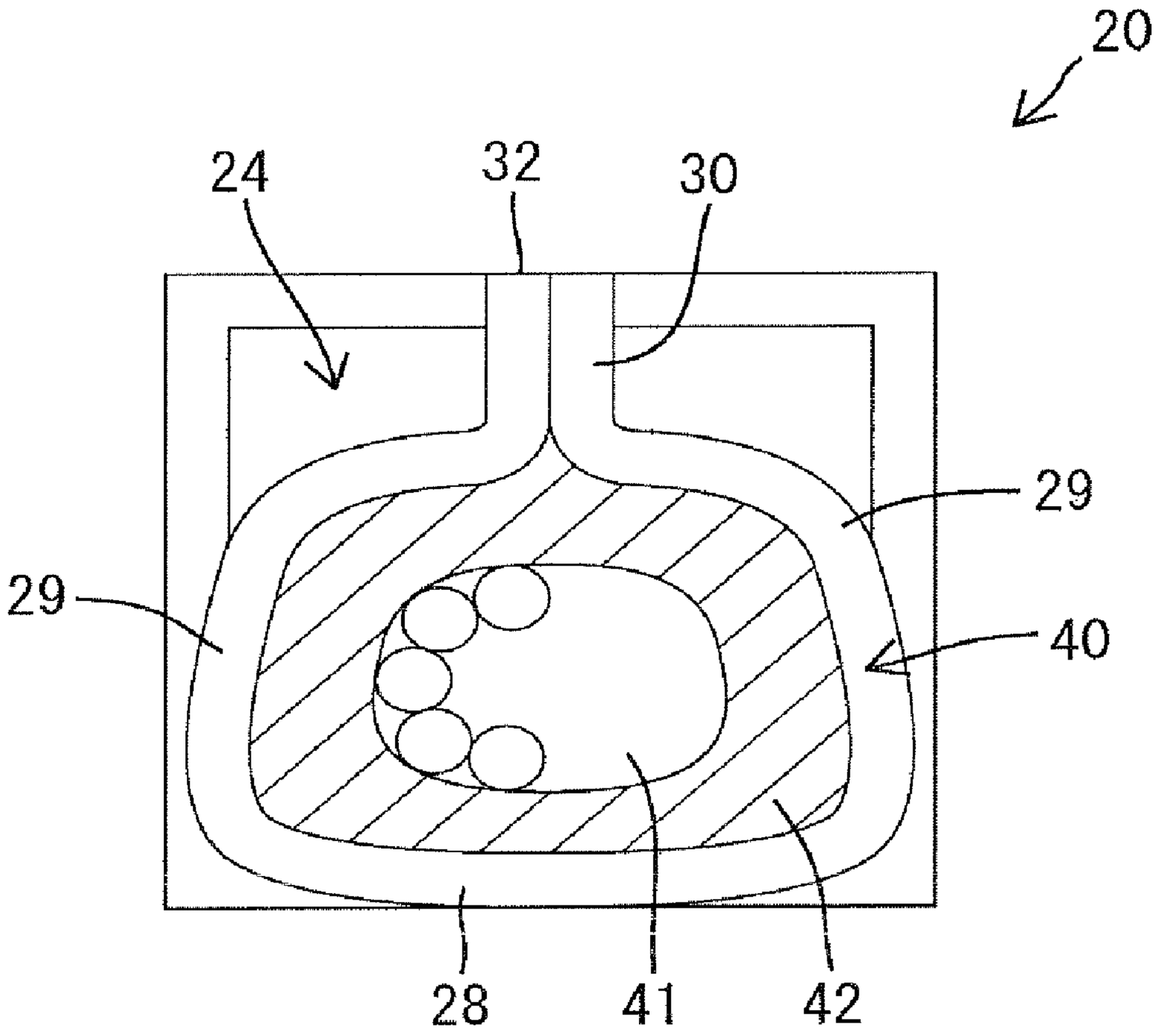


FIG. 1

FIG. 2



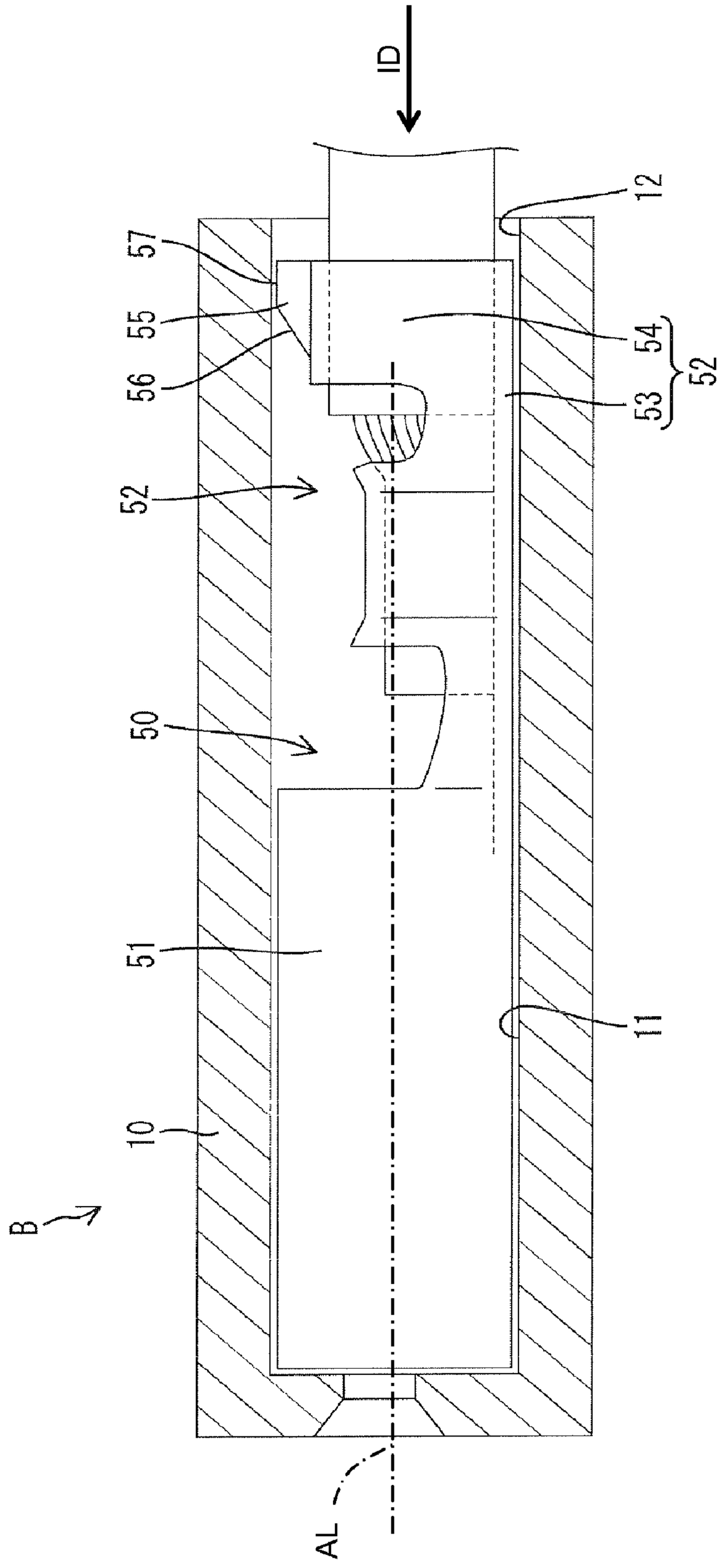


FIG. 3

TERMINAL FITTING WITH POSTURE CORRECTING EDGE AND INCLINATION RESTRICTING PORTION AND A CONNECTOR PROVIDED THEREWITH

BACKGROUND OF THE INVENTION

1. Field of the Invention

The invention relates to a terminal fitting, and to a connector.

2. Description of the Related Art

Japanese Unexamined Utility Model Publication No. 2005-222815 discloses a connector constructed by inserting a terminal fitting into a housing. The terminal fitting includes an open wire barrel at a rear end. The wire barrel is crimped into electrical connection with a conductor exposed by removing an insulation coating of a wire. The wire connected with the terminal fitting then is drawn out of the housing.

Copper with relatively low rigidity is used as a conductor in a general wire. The use of a material that is more rigid than copper (e.g. aluminum) or a material with lower electrical conductivity than copper (e.g. aluminum) leads to a thicker conductor and may result in a more rigid conductor. The wire drawn backward out of the housing may be displaced by an external force acting in a direction intersecting the draw-out direction from the housing. Displacement of a rigid wire could cause the terminal fitting to incline in the housing. Thus a change in the posture of a rigid wire could make a contact state with a mating terminal may unstable and contact reliability may be reduced.

The present invention was developed in view of the above situation and an object thereof is to prevent a terminal fitting from being inclined in a housing upon receiving an external force acting in a direction intersecting with a draw-out direction from the housing.

SUMMARY OF THE INVENTION

The invention relates to a terminal fitting to be inserted into a cavity of a housing of a connector. The terminal fitting has opposite front and rear ends. A terminal connecting portion is near the front end and functions as connecting means with a mating terminal. A wire connecting portion is behind the terminal connecting portion and is configured to be connected with a conductor of a wire. The wire connection portion is formed with at least one inclination restricting portion for restricting an inclination of the terminal fitting in a direction intersecting an axial line direction by contacting an inner wall of the cavity. The wire connecting portion also has at least one posture correcting portion inclined with respect to the axial line direction of the terminal fitting and capable of sliding contact with an opening edge at the cavity in the process of inserting the terminal fitting into the cavity. The inclination restricting portion prevents inclination of the terminal fitting even if an external force acts on the wire in a direction intersecting with a draw-out direction from the housing.

The outer diameter of the wire may be smaller than the terminal connecting portion. Thus, the terminal fitting may be inserted in an inclined posture due to a clearance between the inner wall of the cavity and the insulation barrel. However, the wire connection portion is formed with the posture correcting portion that is inclined with respect to the axial line of the terminal fitting. Therefore, the posture of the terminal fitting can be corrected by the sliding contact of the posture correcting portion with the opening edge of the terminal insertion opening at the cavity even if the terminal fitting is inserted into the cavity in an inclined posture.

The inclination restricting portion preferably is continuous with the posture correcting portion.

The wire connecting portion preferably has at least one wire barrel to be crimped into connection with the conductor exposed by removing an insulation coating of the wire, and/or at least one insulation barrel to be crimped into connection with a part of the wire surrounded by the insulation coating.

The insulation barrel portion preferably is formed with the at least one inclination restricting portion and/or the at least one posture correcting portion.

At least one projection preferably is formed by the extending ends of one or more crimping pieces of the insulation barrel and projects out upon crimping the insulation barrel into connection with the wire.

The projection preferably includes at least one lateral plate having a substantially triangular or pointed shape or a substantially trapezoidal shape when viewed in a lateral direction orthogonal to an axial line of the wire are put together. The projection preferably is formed continuously from the front end to the rear end of the insulation barrel.

The invention also relates to a connector, comprising a housing with at least one cavity therein and at least one of the above-described terminal fittings. The terminal fitting is inserted into the cavity in an inserting direction. The connector is used with a wire that has a conductor surrounded by an insulation coating. The wire connecting portion of the above-described terminal fitting is connected with the conductor exposed by removing the insulation coating and with a part of the wire surrounded by the insulation coating. More particularly, the wire connecting portion preferably includes a wire barrel that is crimped into connection with a front end portion of the conductor exposed by removing the insulation coating and an insulation barrel that is crimped into connection with a part of the wire surrounded by the insulation coating. The wire preferably is drawn backward out of the housing.

The insulation barrel preferably is formed with an inclination restricting portion for restricting an inclination of the terminal fitting in a direction intersecting an axial line direction by contacting an inner wall of the cavity. The insulation barrel also preferably has a posture correcting portion inclined with respect to the axial line direction of the terminal fitting and capable of sliding in contact with an opening edge at the rear end of the cavity in the process of inserting the terminal fitting into the cavity. Thus, the terminal fitting will not incline even if an external force acts on the wire in a direction intersecting a draw-out direction from the housing.

The outer diameter of the wire may be smaller than the terminal connecting portion. Thus, the terminal fitting may be inserted in an inclined posture due to a clearance between the inner wall of the cavity and the insulation barrel. However, the insulation barrel is formed with the posture correcting portion inclined with respect to the axial line of the terminal fitting. Therefore, the posture of the terminal fitting is corrected by the sliding contact of the posture correcting portion with the opening edge of the terminal insertion opening at the rear end of the cavity even if the terminal fitting is inserted into the cavity in an inclined posture.

The inclination restricting portion preferably is continuous with the posture correcting portion. Thus, the insertion of the terminal fitting can be completed smoothly without the front end of the inclination restricting portion getting caught by the opening edge of the cavity.

These and other objects, features and advantages of the present invention will become more apparent upon reading of the following detailed description of preferred embodiments and accompanying drawings. It should be understood that

even though embodiments are separately described, single features thereof may be combined to additional embodiments.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a section of a first embodiment.
FIG. **2** is a rear view of a terminal fitting.
FIG. **3** is a section of a second embodiment.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

A connector in accordance with first embodiment of the invention is identified by the letter A in FIGS. **1** and **2**. The connector A has a housing **10**, at least one terminal fitting **20** and at least one wire **40**.

The wire **40** generally has a known form with a conductor **41** surrounded by an insulation coating **42**. The insulation coating **42** is removed adjacent the front end of the wire **40** to expose the conductor **41** prior to connection with the terminal fitting **20**. The conductor **41** is a material having higher rigidity than copper (e.g. aluminum) and/or a material having lower electrical conductivity than copper (e.g. aluminum).

The housing **10** is made e.g. of a synthetic resin and a long narrow cavity **11** extends through the housing **100** in forward and backward directions. The rear end of the cavity **11** defines as a terminal insertion opening **12** in the rear end surface of the housing **10**.

The terminal fitting **20** is a female terminal formed by bending, folding and/or embossing a conductive (preferably metal) plate material punched or cut out into a specified shape. A rectangular tubular terminal connecting portion **21** is defined at the front end of the terminal fitting **20**. The terminal connecting portion **21** has a known form and can connect with a long narrow tab (not shown) formed on a mating male terminal.

A wire connecting portion **22** is formed at the rear end of the terminal fitting **20** and behind the terminal connecting portion **21** as seen in an inserting direction ID of the terminal fitting into the cavity **11**. The wire connecting portion **22** includes at least one wire barrel **23** formed at a front end of the wire connecting portion **22** and at least one insulation barrel **24** formed behind the wire barrel **23**.

The wire barrel **23** has a first bottom wall **26** and two first crimping pieces **27** project from opposite left and right sides of the first bottom wall **26**. The first crimping pieces **27** can be crimped, bent or folded into electrical connection with the conductor **41** of the wire **40**. Thus, the first crimping pieces **27** are deformed and wound around the conductor **41** on the first bottom wall **26**. The conductor **41** is surrounded fully by the wire barrel **23**. With the wire barrel **23** crimped, bent or folded into connection with the conductor **41**, the height of the upper end of the wire barrel portion **23** is lower than the upper surface of the terminal connecting portion **21**.

The insulation barrel **24** has a second bottom wall **28** that is substantially continuous with the first bottom wall **26** of the wire barrel **23** and two second crimping pieces **29** project from the second bottom wall **28**. The insulation barrel **24** is crimped, bent or folded into connection with a part of a front end of the wire **40** covered by the insulation coating **42**. The crimped, bent or folded second crimping pieces **29** are deformed and wound at least partly around the wire **40** placed on the second bottom wall **28** so that the wire **40** is surrounded by the insulation barrel **24**.

The crimping process is carried out to form a projection **30** at the extending ends of the second crimping pieces **29** of the insulation barrel **24**. The projection **30** projects away from the second bottom wall **28** and is defined by left and right plates that are in face-to-face contact. Each plate of the projection **30** has a substantially triangular shape when viewed in a lateral direction orthogonal to an axial line of the wire **40**. The projection **30** extends continuously from the front end to the rear end of the insulation barrel **24**. The front end of the projection **30** is closest to the second bottom wall **28**, the rear end is farthest from the second bottom wall **28**, and the upper edge of the projection **30** slopes down toward the front. The outer edge of the projection **30** defines as a posture correcting portion **31** from the front end to the rear end. Further, the highest point at the rear end of the projection **30** defines an inclination restricting portion **32**. The lower surface of the second bottom wall **28** of the insulation barrel **24** is at substantially the same height as the lower surface of the bottom wall of the terminal connecting portion **21**, and the upper edge of the inclination restricting portion **32** is at substantially the same height (radial position) as the upper surface of the terminal connecting portion **21**.

The terminal fitting **20** is inserted into the cavity **11** from behind and along the inserting direction ID. The terminal fitting **20** inserted to a substantially proper position is retained by an unillustrated known locking lance. With the terminal fitting **20** inserted, the wire **40** is drawn out backward from the rear surface of the housing **10**. Only tiny clearances are defined at the front end of the terminal fitting **20** between the upper and lower surfaces of the terminal connecting portion **21** and the ceiling and bottom surfaces of the cavity **11** for smoothing insertion of the terminal fitting **20** into the cavity **11**. Thus, there is no space where the terminal fitting **20** vertically shakes.

Only a tiny clearance is defined at the rear end of the terminal fitting **20** between the lower surface of the second bottom wall **28** and the inclination restricting portion **32** for smoothing the insertion of the terminal fitting **20** into the cavity **11**. Thus, there is no space where the terminal fitting **20** vertically shakes. Accordingly, the contact of the second bottom wall **28** with the bottom surface of the cavity **11** or the contact of the inclination restricting portion **32** with the ceiling of the cavity **11** prevents the terminal fitting **20** from inclining in the cavity **11** even if an external force acts on the wire **40** in a direction intersecting a draw-out direction from the housing **10**.

The outer diameter of the wire **40** is smaller than the terminal connecting portion **21**. Thus, the terminal fitting **20** may be inserted in an inclined posture due to a space between an inner wall of the cavity **11** and the insulation barrel **24**. However, the insulation barrel **24** is formed with the at least one posture correcting portion **31** inclined with respect to the axial line AL of the terminal fitting **20** and with respect to the inserting direction ID of the terminal fitting **20** into the cavity **11**. Therefore, the posture of the terminal fitting **20** is corrected by the sliding contact of the posture correcting portion **31** with the opening edge of the terminal insertion opening **12** of the cavity **11** even if the terminal fitting **20** is inserted in an inclined posture into the cavity **11**.

Further, the inclination restricting portion **32** is continuous with the rear end of the posture correcting portion **31**. Thus, the insertion of the terminal fitting **20** can be completed smoothly without the front end of the inclination restricting portion **32** getting caught by the opening edge of the terminal insertion opening **12** of the cavity **11**.

A connector in accordance with a second embodiment of the invention is identified by the letter B in FIG. **3**. The connector B of the second embodiment differs from the first embodiment in the constructions of the inclination restricting portion **57** and the posture correcting portion **56** formed in an insulation barrel **52** of a terminal fitting **50**. The elements that are the same as or similar to the first embodiment are identified by the same reference numerals but are not described again.

The insulation barrel **52** has second crimping pieces **52** that project up from opposite sides of a second bottom wall **53**. The second crimping pieces **52** are crimped, bent or folded into connection with the wire **40**. The crimping process is carried out to form a projection **55** at the extending ends of the second crimping pieces **54**. The projection **55** projects away from the second bottom wall **53** and is formed by left and right plates that are in face-to-face contact. Each plate of the projection **55** has a non-isosceles trapezoidal shape when viewed in a lateral direction orthogonal to an axial line of the wire **40** and is formed continuously from a position behind the front end of the insulation barrel **52** to the rear end of the insulation barrel **52**.

The posture correcting portion **56** is defined by the upper edge at the front end of the projection **55** inclines down toward the front. The front end of the posture correcting portion **56** is closest to the second bottom wall **53** and the rear end thereof is farthest from the second bottom wall **53**. The inclination restricting portion **57** is defined by the upper edge at the rear end of the projection **55** has a substantially constant height. The lower surface of the second bottom wall **53** of the insulation barrel **52** preferably is at substantially the same height as the lower surface of the bottom wall of the terminal connecting portion **51**, and the upper or outer edge of the inclination restricting portion **57** is at substantially the same height as the upper surface of the terminal connecting portion **51**.

A vertical inclination of the terminal fitting **50** inserted into the cavity **11** in the inserting direction ID is restricted by contact of the second bottom wall **53** or the inclination restricting portion **57** of the insulation barrel **52** with an inner surface of the cavity **11**. Further, when the terminal fitting **50** is inserted in an inclined posture into the cavity **11**, the posture correcting portion **56** slides in contact with the opening edge of the terminal insertion opening **12** to correct the posture of the terminal fitting **50**.

The inclination restricting portion **57** is substantially continuous with the rear end of the posture correcting portion **56**. Thus, the terminal fitting **50** is inserted smoothly without the front end of the inclination restricting portion **57** catching the opening edge of the terminal insertion opening **12** of the cavity **11**.

The invention is not limited to the above described and illustrated embodiments. For example, the following embodiments are also embraced by the technical scope of the present invention as defined by the claims.

The inclination restricting portion is continuous with the rear end of the posture correcting portion in the above embodiments. However, it may be spaced back from the rear end of the posture correcting portion.

The terminal fitting is a female terminal fitting in the above embodiments. However, the invention is also applicable to a male terminal fitting with a long narrow tab at the leading end.

The terminal fitting is described as being connected to the wire by crimping. However, any other connection thereto is possible, such as insulation displacement or the like.

What is claimed is:

1. A terminal fitting having opposite front and rear ends spaced apart along an axial line, comprising:

a terminal connecting portion at the front end and configured for connection with a mating terminal; and

a crimping barrel in proximity to the rear end of the terminal fitting and having a bottom wall, first and second crimping pieces extending from the bottom wall and crimped into connection with an outer periphery of a wire, plates extending from ends of the crimping pieces remote from the bottom wall, the plates being disposed substantially in face-to-face contact to define a projection, a posture correcting edge being defined at a front outer part of the projection and sloping toward the bottom wall at positions closer to the front end, an inclination restricting portion being defined on the projection rearward of the posture correcting edge and defining a part of the projection that is farthest from the bottom wall.

2. The terminal fitting of claim **1**, wherein each of the plates is substantially triangular, and the inclination restricting portion defining a point of the triangular plate.

3. The terminal fitting of claim **1**, wherein each of the plates is substantially a trapezoid, and the inclination restricting portion defining a edge of the trapezoidal plate.

4. The terminal fitting of claim **1**, wherein the terminal connecting portion defines a maximum height measured normal to the bottom wall and wherein the inclination restricting portion is spaced from an outer surface of the bottom wall by a distance substantially equal to the maximum height of the terminal connecting portion.

5. The terminal fitting of claim **1**, further comprising a core connecting portion forward of the insulation barrel and configured for connection to a conductive core of the wire.

6. A connector, comprising:

a housing formed with at least one cavity therein;

a wire having a conductor at least partly surrounded by an insulation coating;

at least one terminal fitting having opposite front and rear ends spaced apart along an axial line, a terminal connecting portion at the front end thereof and configured for connection with a mating terminal, a wire connecting portion behind the terminal connecting portion and being configured to be connected with a wire, the wire connection portion being formed with a crimping barrel in proximity to the rear end of the terminal fitting and having a bottom wall, first and second crimping pieces extending from the bottom wall and crimped into connection with an outer periphery of wire, plates extending from ends of the crimping pieces remote from the bottom wall, the plates being disposed substantially in face-to-face contact to define a projection, at least one inclination restricting portion disposed at a rear outer part of the projection and configured for restricting an inclination of the terminal fitting in a direction intersecting the axial line direction by contacting an inner wall of the cavity, and at least one posture correcting portion at a front part of the projection and inclined with respect to the axial line direction of the terminal fitting, the posture correcting portion being disposed for sliding contact with an opening edge of the cavity while inserting the terminal fitting into the cavity; and

a wire having a conductor at least partly surrounded by an insulation coating, the wire connecting portion being connected with the wire surrounded by the insulation coating.

7. The connector of claim **6**, wherein the posture correcting portion slopes towards the bottom wall of the terminal fitting at a position closer to the front end.

8. The connector of claim **6**, wherein the inclination restricting portion defines a part of the projection that is farthest from the bottom wall of the terminal fitting.

9. The connector of claim **6**, wherein each of the plates is substantially triangular, and the inclination restricting portion defines a point of the triangular plate.

10. The connector of claim **6**, wherein each of the plates is substantially a trapezoid, and the inclination restricting portion defines a edges of the plates.

11. The connector of claim **6**, further comprising a core connecting portion forward of the insulation barrel and configured for connection to a conductive core of the wire.

* * * * *